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Glandular Trichome Morphology of *Sideritis montana* L. supsp. *remota* (d'URV) (Lamiaceae)

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ABSTRACT: In the paper, glandular trichome morphology of *Sideritis montana* L. subsp. remota (d'URV) (Lamiaceae) was examined. *Sideritis montana* subsp. *remota* is called "Mor karaçay" in Turkey. Vegetative and reproductive organs of the plant were fixed in 70% ethyl alcohol to determine glandular trichome types and glandular trichome distribution. Three subtypes of capitate glandular trichomes were determined. These were subtype IIA, subtype IIB and subtype IIC. Subtype IIA and subtype IIB were seen on both vegetative and reproductive organs, whereas subtype IIC was observed on only reproductive ones. Peltate glandular trichomes have a head which is composed of four celled. These trichomes were also observered on leaf surfaces. The determination of glandular trichome types and the distribution of the trichomes in *Sideritis montana* subsp. *remota* is imported findings to be used in future systematic implication.

Keywords: Glandular trichome, morphology, *Sideritis montana subsp. remota,* Lamiaceae

INTRODUCTION

Sideritis L. genus belongs to the family of Lamiaceae family. The genus exists in different habitats and altitudes ranging from North Pole to the Himalayas, North East Asia to Hawai, Africa Australia, and America, whereas the main habitat is the Medirterreanaen area (Heywood, 1996). Lamiaceae has 224 genus and about 5600 species in the world (Hickey and King, 1997). This family in Turkey exists with 45 genus, 565 species and totally with 735 taxa (Guner et al., 2000). *Sideritis* L. genus is called "Dağ çayı, Ada çayı, Yayla çayı, Balbaşı" in Anatolia. *Sideritis montana* L. subsp. *remota* (d'URV) is named "mor karaçay" by Turkish people. It was reported that *Sideritis* species were also used as medicinal plant to treatment of cough, cold and as diuretic in Turkey (Sezik and Ezer, 1983; Başer, 1995; Baytop, 1999).

A lot of studies are carried out on chemical ingredients of *Sideritis* genus (Akcos, 1994). Besides, the studies about chromosome numbers of *Sideritis* genus were made by many researchers (Baltisberger, 1991; Aydın, 1993; Kesercioğlu and Nakipoğlu, 1996). Lytra et al. (2021) investigated the biological activities of the methanol extract of *S. cypria*. Glandular trichomes studies of *Sideritis* species are limited in the literatures. Glandular trichomes are also used in plant systematic. The goal of the paper was to examine the glandular trichome morphology of *S. montana* subsp. *remota*.

MATERIALS AND METHOD

The plant material was *S. montana* supsp. *remota* in the study. The plant was collected in flowering seasons from Köseler village of Gümüşhacıköy in Amasya, Turkey (1050 m, Cansaran 4200) on 14.05.2016. Their systematic descriptions were carried out according to Davis (1982). The study was carried out in Department of Biology, Faculty of Art and Science, Amasya University.

Plant samples of the plant was fixed in 70% ethyl alcohol to determine the trichome micromorphology. 30 fresh specimens were used in the study. The sections of plant samples were performed by hand. Sartur reagent was used for dying (Çelebioğlu and Baytop, 1949). Trichome preparations were photographed with a Leica ICC50 HD binocular light microscope. The glandular trichome types and distributions were described. These types studied in the paper were classified following the procedure of Metcalfe and Chalk (1979). To investigate the glandular trichomes of the plant, the surfaces of some organs such as leaves and flowers were also photographed with scanning electron microscope (SEM 515, Philips, The Netherlands). The specimens were prepared according to Robinson et al. (1987).

RESULTS and DISCUSSION

Capitate glandular type had a basal epidermal cell, unicellular to bicellular stalk cell and a large unicellular or bicellular head. In the present study, three subtypes of capitate glandular ones were determined: These were subtype IIA, subtype IIB and subtype

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IIC. Subtype IIA: A globose unicellular or bicellular head and a stalk of one to two cells (Figure 2 a, b, c). Subtype IIB: A cup-shape unicellular head an one to two-celled stalk (Figure 2 d, e, f, g) . Subtype IIC: A hemispherical unicellular head and a unicellular or bicellular stalk (Figure 2 h). In the study, subtype IIA had one or two stalk cells, one base cell and one or two head cells on stem, leaf on flower surfaces of S. montana subsp. remota. However, subtype IIB had two stalk cells, one base cell and one head cell on leaf and flower surfaces (Table 1). On the other hand, subtype IIC had one stalk cell, one base cell and one head cell on flower surface of the plant (Table 1). Peltate trichomes were only seen on leaf surfaces of *S. montana* subsp. *remota*. Leaf surfaces of the plant were covered with these trichomes.

Table 1. *Glandular trichome types on vegetative and reproductive organs of S. montana subsp. orientale*

	Capitate type (Type II)									Peltate type (Type I)
	Type IIA			Type IIB			Type IIC			
Plant organ	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell	Head cell	Stalk cell	Base cell	Number of head cell
Stem	1	1	1	-	-	-	-	-	-	-
	2	1	1	-	-	-	-	-	-	-
Leaf	1	1	1	1	1	1	-	-	-	4
	2	2	1	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	8
	-	-	-	-	-	-	-	-	-	
Flower	1	1	1	1	1	1	1	1	1	-
	2	1	1	1	2	1	-	-	-	-

S. montana subsp. *remota* had subtype IIA and subtype IIB trichomes on both vegetative and reproductive organs while subtype IIC was only seen reproductive organ (Table 2). On the other hand, subtype IIC capitate trichomes were rarely seen on flower surfaces, whereas subtype IIA and subtypes IIB were often observed on stem, leaf and flower surfaces. Glandular trichomes have imported features in plant taxonomy of Lamiaceae family (Metcalfe and Chalk, 1979; Azizian and Culter, 1982). Capitate glandular trichomes (Type II) and peltate ones (Type I) are often observed in species of Lamiaceae. In the study, it was found that the numbers of head cell of peltate trichomes in *S. montana* subsp. *remota* were four (Figure 1a, 1b). Peltate trichomes consisting of a four or twelve celled head in a single circle had been reported before (Corsi and Bottega, 1999; Hallahan, 2000; Kamatou et al., 2006; Kamatou et al., 2007). These trichomes were also seen on leaf surfaces of *S. montana* subsp. *remota*. Leaf surfaces of the plant were covered with these trichomes. Some researchers determined that peltate trichomes were observed abundantly on calyx surfaces of flower in plants (Serrato-Valenti et al., 1997; Corsi and Bottega, 1999).

Table 2. *Glandular trichome distribution on vegetative and reproductive organs of S. montana supsp. annua remota*

	Capitate type (Type II)			Peltate type
Plant organ	Type IIA	Type IIB	Type IIC	(Type I)
Stem	+++	-	-	-
Leaf	+++	+++	-	+++
Flower	+++	+++	+	-

(-), (+), (++) and (+++) denotes absence, a few and a lot of trichomes, respectively

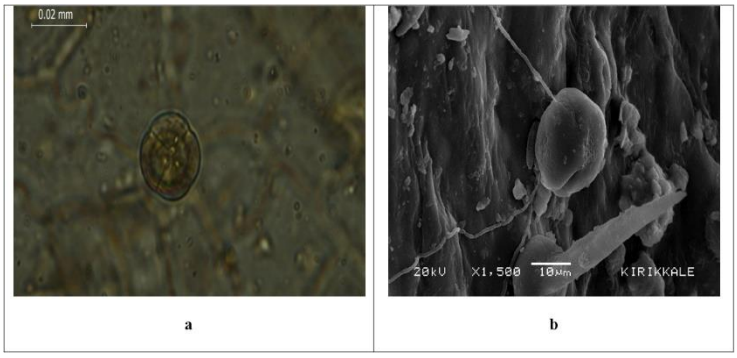

Figure 1. *Peltate (Type I) trichomes of S. montana subsp. remota on vegetative organs. Leaf surfaces (a, b)*

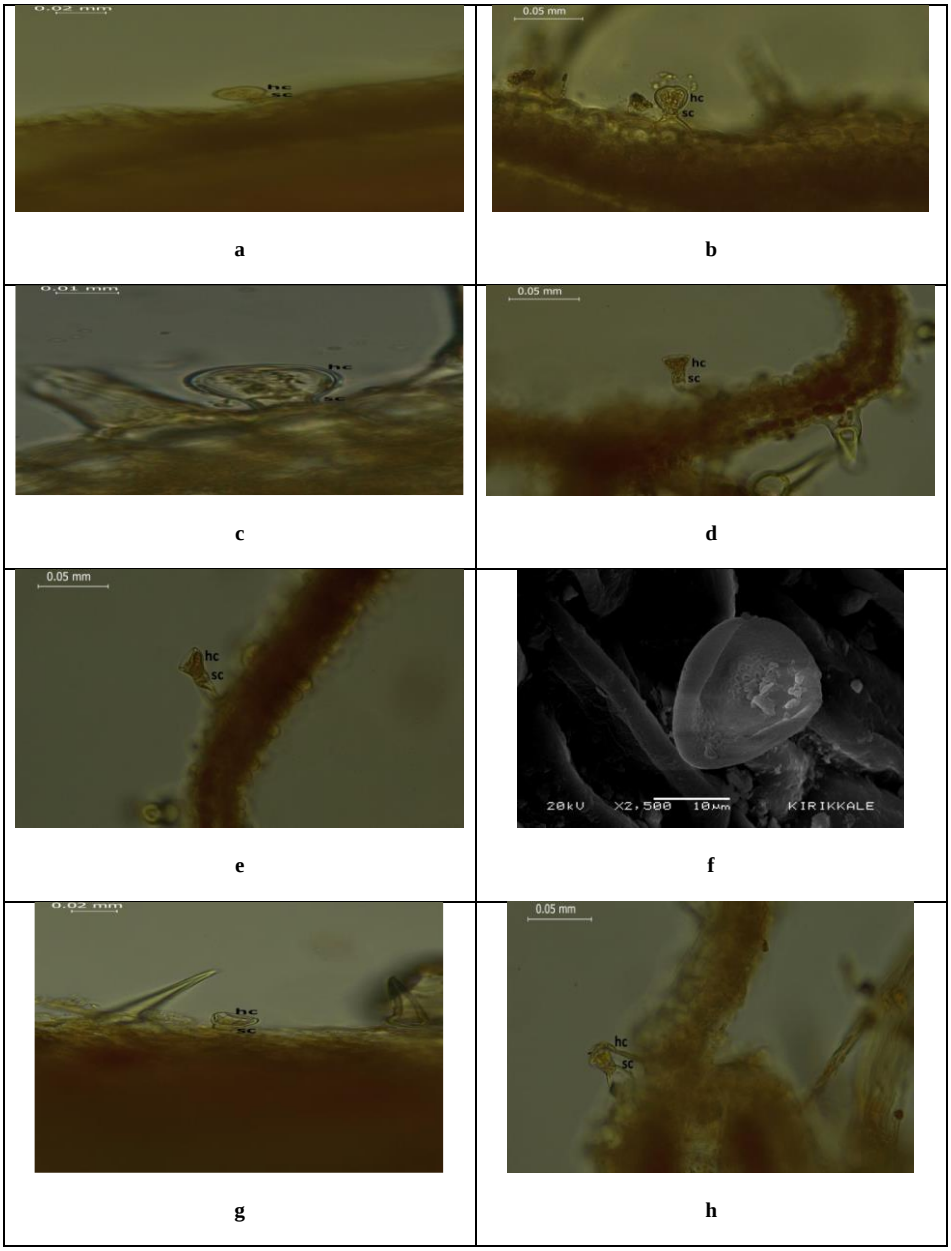

Figure 2. *Capitate glandular (Type II) trichomes of S. montana subsp. remota on vegetative and reproductive organs. Subtype IIA on stem (a, b, c) Subtype IIB on flower (d, e, f, g) Subtype IIC on flower (h) hc: head cell sc: stalk cell*

When it comes to capitate glandular (Type II) trichomes, these trichomes were seen on both vegetative and reproductive organs of *S. montana* subsp. *remota*. Subtype IIA, subtype IIB and subtype IIC of capitate glandular were found in the study. Serrato-Valenti et al. (1997) reported that all subtypes of capitate glandular mentioned above were observed in other Lamiaceae family. Subtype IIA has a globose unicellular or bicellular head and a stalk of one to two cells, whereas subtype IIB has a cup-shape unicellular head an one to two-celled stalk. Subtype IIC has a hemispherical unicellular head and a unicellular or bicellular stalk. In the present study, subtype IIA had one or two stalk cells, one base cell and one or two head cells on stem, leaf and flower surfaces of *S. montana* subsp. *remota*. However subtype IIB had one or two stalk cells, one base cell and one head cell on leaf, flower surfaces. Subtype IIC had one stalk cell, one base cell and one head cell on flower surfaces of the plant. Subtypes IIA and IIB were observed on vegetative and reproductive organs. However, subtype IIC was only seen on flower surfaces. Glandular trichomes especially capitate glandular ones have imported function for pollination in Lamiacea family (Navarro and El Oualidi, 2000). Azizian and Culter (1982) said that capitate glandular trichomes were important taxonomic characters and had significant function for pollination in Lamiaceae. Werker et al. (1985) also reported these trichomes on calyx and corolla of species in Lamiaceae family.

CONCLUSION

In conclusion, subtype IIA, subtype IIB and subtype IIC of capitate glandular trichomes were determined in the study. Subtype IIA and subtype IIB were seen on both vegetative and reproductive organs, whereas subtype IIC was observed on only reproductive ones. Peltate glandular trichomes have a head which is composed of four celled. These trichomes were also observed on leaf surfaces. The determination of glandular trichome types and the distribution of the trichomes in S. montana subsp. remota is imported findings to be used in future systematic implication.

CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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